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**Epidemiologic and economic evaluation of different forms of tobacco  
prevention for Switzerland: an analysis of exemplary interventions using  
secondary data**

Rehm, Jürgen ; Zahringer, S ; Egli, S ; Patra, J

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Band 2/3: Prävention  
Volume 2/3: Prévention



BAG OFSP UFSP SFOPH

Band  
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2

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# Epidemiologic and Economic Evaluation of Different Forms of Tobacco Prevention for Switzerland: an Analysis of Exemplary Interventions Using Secondary Data\*

Jürgen Rehm, Susanne Zähringer, Samy Egli, Jayadeep Patra, Research Institute for Public Health and Addiction ISGF, Zurich

## Summary

Based on a systematic literature review, three exemplary interventions to reduce tobacco-related harm were selected and their impact was assessed:

1. nicotine replacement therapies;
2. taxation increases;
3. community interventions.

Specifically, impact was assessed by modeling with respect to:

- Effects on reducing prevalence rates of cigarette smoking in Switzerland;
- Effects on population attributable fractions for lung cancer and coronary heart disease. These conditions were selected because they constitute the major tobacco-related burden of disease in established market economies.
- Effects on reductions of disease-specific mortality for Switzerland.

Taxation measures and nicotine replacement therapy have effected a sizeable reduction in mortality for both lung cancer and coronary heart disease. In realistic scenarios, between 3.3% and 4.2% of lung cancer mortality, and between 2.5% and 2.8% of coronary heart disease mortality could be reduced by these interventions within one year. However, in large controlled studies community interventions for reducing smoking, did not show any effects larger than what may be produced by chance and were not modeled further.

With respect to cost-effectiveness, taxation increases are clearly more cost-effective than nicotine replacement therapies, as intervention is not necessary at the level of the individual smoker. The implications of these findings are discussed below. Future research should focus on interventions to optimize reductions in tobacco-related harm. However, the modeling of the three interventions described has already indicated important directions for potential interventions.

It is clear that cost-effective anti-smoking interventions are available, offering the potential to reduce the smoking-related burden of disease in Switzerland within a short period of time.

## 1. Introduction

Based on recent publications (Ezzati et al., 2002; Shibuya et al., 2003), we decided to model the impact of different interventions in burden of disease terms. This procedure can be justified by the fact that for tobacco use – in contrast to alcohol and illicit drugs use – the overwhelming majority of direct costs materializes in health care (see Single et al., 1996, 1998). We used two tracer diagnoses to operationalize burden of disease: lung cancer and coronary heart disease, diagnoses which account for the majority of tobacco-related mortality and burden of disease both in established market economies and also globally (WHO, 2002).

To estimate tobacco-attributable mortality and burden of disease for both risk factor-disease pairs, population attributable fractions were calculated using standard epidemiological techniques (Walter, 1976; 1980). Population attributable fractions denote the proportion of mortality of a disease which is caused by a given risk factor, in this case tobacco.

## 2. Methods

*Exposure* to smoking was taken from the Swiss Health Survey (Schweizerische Gesundheitsbefragung) 2002. Details of this survey can be obtained from the website of the Swiss Federal Office of Statistics ([www.bfs.admin.ch](http://www.bfs.admin.ch) and [www.statistik.admin.ch/stat-ch/ber14/dtfr14-s.htm](http://www.statistik.admin.ch/stat-ch/ber14/dtfr14-s.htm)).

In order to model smoking behaviour in a society with a socio-political climate exerting pressure towards reducing smoking rates we assumed four different scenarios based on the literature, trends observed in regions of North America and Australia featuring intense efforts to reduce tobacco related harm (see, for example [www.sfa-isp.ch](http://www.sfa-isp.ch); Tillgren et al., 1995; Bondy et al., 2000). These scenarios were based on:

- quitting rates of 5%/10%/15%/25%;
- the assumption that 80% of smokers wanted to quit,
- the assumption of an annual incidence rate of 0.46% for current female non-smokers, and a prevalence proportionate incidence rate for males.

## Key Words

Tobacco  
Interventions  
Mortality  
Lung Cancer  
Coronary Heart Disease  
Cost-Effectiveness

\* This project was supported by the Swiss Federal Office of Public Health, contract number 02.001044.

We modeled the *risk relations* between smoking and disease outcomes based on English et al. (1995). This model avoids sole reliance on one study, which is the major problem of SAMNEC and other ready-made software. (SAMNEC is based on the American Cancer Society CPS-2 Study Proceedings of the Workshop on Changing Mortality Roles of Tobacco-Related Diseases, 1997.) We used sex- and age-specific estimates for coronary heart disease, and sex-specific ones for lung cancer.

Based on the literature, three kinds of *interventions* were modeled as examples:

- nicotine replacement therapies
- taxation increases
- community interventions for reducing smoking

For each we estimated the effect on prevalence, the subsequent change in attributable fraction and the estimated reduction in disease prevalence.

### 3. Results

The results showed a sizeable reduction in mortality for both lung cancer and coronary heart disease for both taxation and nicotine replacement therapy. In realistic scenarios, between 3.3% and 4.2% of lung cancer mortality, and between 2.5% and 2.8% of coronary heart disease mortality could be reduced by these interventions within one year (for details see tables below as well as Rehm et al., 2004). Community interventions in large controlled studies did not show effects larger than chance in reducing smoking and thus were not modeled further. Tables 1 and 2 show the proportional mortality reduction in different scenarios for nicotine replacement therapies and taxation decreases.

We refrained from applying a formal cost-effectiveness analysis (e.g. Chisholm et al, 2004; Drummond et al., 1997; Shibuga et al, 2003; Tan-Torres Edejer et al., 2003) as the results would not have helped clari-

**Table 1: Proportional mortality reduction in percent in first year resulting from nicotine replacement therapy (NRT) interventions**

Scenarios	Females		Males	
	Lung cancer	Coronary heart disease	Lung cancer	Coronary heart disease
<b>Prevalence of 2002</b>	76.78	34.68	85.05	43.42
'Natural course' 5% reduction (–5%)	0.8	0.5	0.3	0.3
'Natural course' –10%	2.3	1.4	1.6	1.4
'Natural course' –15%	3.8	2.3	3.0	0.9
'Natural course' –5% plus NRT on all willing to change	2.0	1.2	1.4	1.2
'Natural course' –10% plus NRT on all willing to change	4.7	2.8	3.8	3.3
'Natural course' –15% plus NRT on all willing to change	7.5	4.5	6.3	5.4
'Natural course' –5% plus NRT on 75% willing to change	1.7	1.0	1.1	0.9
'Natural course' –10% plus NRT on 75% willing to change	4.1	2.5	3.3	2.8
'Natural course' –15% plus NRT on 75% willing to change	6.5	3.9	5.5	4.7
Most optimistic scenario –25% plus NRT on all willing to change	12.8	7.8	11.7	10.1

Most realistic scenario is highlighted in italics.

The natural course assumption is modeled only on 80% of the smokers, assuming that only 80% would like to reduce smoking or quit.

**Table 2: Proportional mortality reduction in percent in first year resulting from taxation**

Scenarios	Females		Males	
	Lung cancer	Coronary heart disease	Lung cancer	Coronary heart disease
<b>Prevalence of 2002</b>	76.78	34.68	85.05	43.42
'Natural course' 5% reduction (–5%); tax increase 0.50 CHF; elasticity –.25	1.8	1.1	1.2	1.0
'Natural course' –10%; tax increase 0.50 CHF; elasticity –.25	3.3	2.0	2.5	2.2
'Natural course' –15%; tax increase 0.50 CHF; elasticity –.25	4.8	2.9	3.9	3.3
'Natural course' –25%; tax increase 0.50 CHF; elasticity –.25	7.8	4.7	6.6	5.6
'Natural course' –5%; tax increase 0.50 CHF; elasticity –.50	2.7	1.6	2.0	1.7
'Natural course' –10%; tax increase 0.50 CHF; elasticity –.50	4.2	2.5	3.3	2.8
'Natural course' –15%; tax increase 0.50 CHF; elasticity –.50	5.1	3.4	4.7	4.0
'Natural course' –25%; tax increase 0.50 CHF; elasticity –.50	8.7	5.3	7.4	6.3
'Natural course' –5%; tax increase 1.00 CHF; elasticity –.25	2.7	1.6	2.0	1.7
'Natural course' –10%; tax increase 1.00 CHF; elasticity –.25	4.2	2.5	3.3	2.8
'Natural course' –15%; tax increase 1.00 CHF; elasticity –.25	5.1	3.4	4.7	4.0
'Natural course' –25%; tax increase 1.00 CHF; elasticity –.25	8.7	5.3	7.4	6.3
'Natural course' –5%; tax increase 1.00 CHF; elasticity –.50	4.5	2.7	0.5	3.0
'Natural course' –10%; tax increase 1.00 CHF; elasticity –.50	6.0	3.6	4.9	4.2
'Natural course' –15%; tax increase 1.00 CHF; elasticity –.50	7.5	4.5	6.3	5.4
'Natural course' –25%; tax increase 1.00 CHF; elasticity –.50	10.5	6.3	9.0	7.7

Most realistic scenario is highlighted in italics.

The natural course assumption is modeled only on 80% of the smokers, assuming that only 80% would like to reduce.



fy the conclusions. Taxation is clearly the most cost-effective of the interventions examined. It yields about the same level of mortality reduction as nicotine replacement therapies, but requires only a fraction of the cost. For nicotine replacement therapies, we are faced with the resource needs of the supply of nicotine gum or other forms of nicotine replacement for more than one million Swiss smokers, even if only 75% of those willing to quit were reached. While an effort of this kind may be effective in reducing prevalence rates, and even cost-beneficial (Drummond et al., 1987) given the high costs of smoking in Switzerland (Vitale et al, 1998), it is certainly not cost-effective for the government in comparison with alternatives like taxation increases. Overall Swiss taxes on cigarettes are not high compared with those in other European countries. This analysis remains valid despite the possibility that taxation increases may increase cross-border smuggling of tobacco products, and consequently lead to an increase in law enforcement costs.

As for community interventions, it makes no sense to consider their cost-effectiveness, since these programmes have not been found effective.

#### 4. Discussion

Both nicotine replacement therapies and taxation increases could reduce the tobacco-related burden for Switzerland. While we modeled only these exemplary approaches, there are other approaches which have been proven effective in rigorous evaluations, such as active enforcement of laws on minors (Stead & Lancaster, 2002). Overall, the literature clearly converges on the view that societal approaches involving laws and regulations are both effective and cost-effective in reducing tobacco-related harm (Cummings, 2002). It remains unclear if there is a point at which these measures will become less effective, as they may not influence more hardened smokers, but certainly as far as Switzerland is concerned, this point is not yet in sight.

#### 5. Recommendations

Taxation should be considered as the first line intervention for reducing tobacco-related harm.

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## 7. Valorisation

We hope that this study will contribute to evidence-based interventions to further reduce tobacco-related harm in Switzerland.

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